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SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
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08/276,797 07/18/94 OWEN M 2686033:37US

21M1/1102  
STOEL RIVES BOLEY JONES & GREY  
900 SW FIFTH AVENUE SUITE 2300  
PORTLAND OR 97204-1268

MILLS, G  
EXAMINER

ART UNIT PAPER NUMBER

2106 6

This is a communication from the examiner in charge of your application.  
COMMISSIONER OF PATENTS AND TRADEMARKS

DATE MAILED: 11/02/95

☒ This application has been examined ☒ Responsive to communication filed on 09/25/95 ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 MONTHS from the date of this letter.  
Failure to respond within the time period will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENTS ARE PART OF THIS ACTION:

- ☒ Notice of References Cited by Examiner, PTO-892.
- ☒ Notice re Patent Drawing, PTO-948.
- ☒ Notice of Art Cited by Applicant, PTO-1449
- ☐ Notice of Informal Patent Application, Form PTO-152.
- ☐ Information on How to Effect Drawing Changes, PTO-1474.
- ☐

Part II SUMMARY OF ACTION

- ☒ Claims 1-13, 15-17, 22-27 are pending in the application.  
Of the above claims,        are withdrawn from consideration.
- ☒ Claims 14, 18-21 have been cancelled.
- ☐ Claims        are allowed.
- ☒ Claims 1-13, 15-17, 22-27 are rejected.
- ☐ Claims        are objected to.
- ☐ Claims        are subject to restriction or election requirement.
- ☒ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
- ☐ Formal drawings are required in response to this Office action.
- ☐ The corrected or substitute drawings have been received on       . Under 37 C.F.R. 1.84 these drawings are ☐ acceptable. ☐ not acceptable (see explanation or Notice re Patent Drawing, PTO-948).
- ☐ The proposed additional or substitute sheet(s) of drawings, filed on        has (have) been ☐ approved by the examiner. ☐ disapproved by the examiner (see explanation).
- ☐ The proposed drawing correction, filed on        has been ☐ approved. ☐ disapproved (see explanation).
- ☐ Acknowledgment is made of the claim for priority under 35 USC 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no.       ; filed on       .
- ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
- ☐ Other

EXAMINER'S ACTION

08/276,797

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1. During a telephone conversation with Mr. Michael Levine on 9/22/95, a restriction requirement was made between original claims 1-12, 22 and original claims 13-21. In response thereto, applicant submitted the preliminary amendment of 9/25/95, obviating the restriction requirement. All presently pending claims have been examined.
2. This application is being examined in Group Art Unit 2106, not 2501 as indicated on the preliminary amendment of 9/25/95. To avoid potential delays, please address future correspondence to Group Art Unit 2106.
3. Claims 6, 7, and 27 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

"The spatial spot size is less than about 50  $\mu\text{m}$ " and "a spatial region ... greater than 25  $\mu\text{m}$ " are indefinite because "spot size" and "spatial region" define two dimensional areas, whereas " $\mu\text{m}$ " is a measure of one dimensional length.
4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

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(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claims 1-10, 12, 24, and 25 are rejected under 35 U.S.C. § 102(a) as being anticipated by the fall 1993 issue of "Laser Pulse" published by Electro Scientific Industries, Inc.

Referring to pages 6 and 7 and the unnumbered page entitled "4420 Laser Micromachining System", the fall 1993 issue of Laser Pulse discloses a method of laser processing multi-layered targets comprising generating high power UV laser pulses from an ESI Model 4420 solid state Nd:YAG laser system operating at a wavelength of 266 nm (page 6) which produces 45 nanosecond pulses having average powers of 300 mW at a repetition rate of 2 kHz (as shown on the unnumbered page), and applying the above pulses to multi-layered targets to cleanly remove at least two layers having different compositions and absorption characteristics (see the figures on pages 6 and 7). The targets include Novaclad (page 6) which is a copper-polyimide laminate. A laminate with three different layers is shown after processing at the bottom right of page 7. Vias of 25 micron diameter are formed (page 6), indicating that the laser is focused to a spot of no more than 25  $\mu\text{m}$ . At the top of page 7, larger 6 mil vias are formed. At the bottom of page 7, through holes having aspect ratios greater than 2 are formed.

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6. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

7. Claim 11 is rejected under 35 U.S.C. § 103 as being unpatentable over the fall 1993 fall 1993 issue of Laser Pulse as applied to claims 1-10, 12, 24, and 25 above, and further in view of U.S. Patent 4,761,786 to Baer.

The fall 1993 issue of Laser Pulse discloses the invention substantially as claimed, but does not show a YAG laser doped with holmium or erbium.

Referring to the abstract, Baer teaches doping YAG lasers with holmium or erbium to increase the laser's energy storage ability. It would have been obvious to one of ordinary skill in the art at the time the invention was made to dope the YAG laser

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of the fall 1993 issue of Laser Pulse with holmium or erbium to increase its energy storage ability as taught by Baer.

8. Claims 13, 15, 26, and 27 are rejected under 35 U.S.C. § 103 as being unpatentable over the fall 1993 fall 1993 issue of Laser Pulse as applied to claims 1-10, 12, 24, and 25 above, and further in view of U.S. Patent 4,894,115 to Eichelberger et al.

The fall 1993 issue of Laser Pulse discloses the invention substantially as claimed, but does not show the spatial spot size being smaller than a spatial region of the target or the output pulses being sequentially directed to multiple positions within the spatial region.

Referring to Figures 2A-2C, for example, Eichelberger teaches a method of forming vias by laser ablation which includes using a beam with a spatial spot size smaller than a spatial region of the target, and directing the beam to multiple positions within the spatial region to remove multiple amounts of material. The beam is applied along a periphery (130) of the via. Eichelberger teaches that the above method allows vias of various sizes and shapes to be formed as desired. See col. 3, lines 19-23. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a beam with a spatial spot size smaller than a spatial region of the target area and to direct the beam pulses sequentially to multiple

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portions of the spatial region to form vias of different sizes and shapes as taught by Eichelberger.

Regarding claims 26 and 27, the three-material structure shown at the lower right of page 7 in Laser Pulse would have suggested to one of ordinary skill in the art a target of copper, polyimide, and ceramic, for example, since such structures are commonly used to form interconnect devices such as MCM's.

9. Claims 16 and 17 are rejected under 35 U.S.C. § 103 as being unpatentable over the fall 1993 issue of Laser Pulse in view of Eichelberger as applied to claims 13, 15, 26, and 27 above, and further in view of U.S. Patent 3,931,458 to Dini.

The fall 1993 issue of Laser Pulse in view of Eichelberger discloses the invention substantially as claimed, but does not show using an outwardly spiraling beam path to form a blind via.

The inclusion of blind vias in multi-layer electrical devices is old and well-known in the art. Using laser ablation to form such blind vias was also known in the art at the time the invention was made. To one of ordinary skill in the art at the time the invention was made, it would have been an obvious use of the Laser Pulse method to form a blind via.

Referring to Figures 1-4, Dini discloses a laser etching method which includes moving the beam outwardly from a central portion of a region in a spiral path. Dini teaches that the

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depth of etching may be easily controlled by controlling the tightness of the spiral. Compare Figures 1 and 3 with Figures 2 and 4. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form blind vias using an outwardly spiralling path to allow easy control of the vias depth as taught by Dini.

10. Claims 22 and 23 are rejected under 35 U.S.C. § 103 as being unpatentable over the fall 1993 issue of Laser Pulse.

The fall 1993 issue of Laser Pulse discloses the invention substantially as claimed, but does not show blind via formation or two layers being removed with a single pulse.

The inclusion of blind vias in multi-layer electrical devices is old and well-known in the art. Using laser ablation to form such blind vias was also known in the art at the time the invention was made. To one of ordinary skill in the art at the time the invention was made, it would have been an obvious use of the Laser Pulse method to form a blind via.

The selection of the beam parameters necessary to remove two layers of material with one pulse is within the ordinary level of skill in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove two layers with one pulse to increase processing speed.

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11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

LaPlante, Hamilton, and Wang show similar laser drilling systems.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory Mills whose telephone number is (703) 308-1633. Faxes may be sent to (703) 305-3431 or (703) 305-3432.

Gregory Mills  
October 6, 1995

  
TERESA J. WALBERG  
SUPERVISORY PATENT EXAMINER  
GROUP 2100